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**LOUISIANA DEPARTMENT OF WILDLIFE AND FISHERIES
NEW ORLEANS, LOUISIANA**

**A STUDY OF AREAL AND SEASONAL ABUNDANCE OF
THE AMERICAN EEL (*ANGUILLA ROSTRATA*)
AT SELECTED SITES IN SOUTHEASTERN COASTAL LOUISIANA**

BY
**L. BRANDT SAVOIE
AND
KEITH L. CASANOVA**

Technical Bulletin No. 34

May, 1982

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TABLE OF CONTENTS

Acknowledgements	vi
Abstract	vii
Introduction	1
Area Description	1
Materials and Methods	3
Biology	3
Hydrology	23
Discussion and Recommendations	26
Literature Cited	27

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ABSTRACT

Three areas of southeastern coastal Louisiana were sampled for American eel (*Anguilla rostrata*) twice monthly from April 1, 1979, through March 31, 1981. Areas sampled were selected from data collected during three months of preliminary investigation conducted from January through March 1979. Data from the selected sites were analyzed to determine the areal and seasonal availability of eels in this portion of coastal Louisiana. Results of data analysis are presented to enable the formulation of sound management recommendations to govern any future development of the eel fishery in Louisiana.

Eels were taken using locally designed commercial-type eel traps. Eels taken were recorded individually by both length and weight; incidental catch was recorded by total number and total weight of each species encountered. Hydrological and climatological data were also recorded. Eel catches were correlated with recorded salinities and temperatures and are presented in this manner.



INTRODUCTION

The eel fishery in this country, although still underdeveloped, dates back to the time of the Pilgrims. Eels have been shunned, however, by most people in the United States, and the eel fishery has never really flourished in this country (Lane 1978). According to Berg et. al. (1975), many Europeans and Asians have long considered eel a delicacy, and the number of Americans who like eels is increasing. Recent favorable prices and publicity have generated considerable interest in developing an eel fishery in coastal southeastern states (Abbas 1977). The demand-supply situation has created conditions favorable for an eel fishery (Berg et. al. 1975).

From 1965 to 1973, the United States landed only 8,708 tons (7,900 metric tons) of eels while European countries landed 196,872 tons (178,600 metric tons) (Food and Agriculture Organization of the United Nations 1974). During 1972, 14 states landed approximately 750 tons (680 metric tons) of eels, with a dockside value of over \$400,000 (Lane 1978). During 1975, 350 eel fishermen in North Carolina brought home more than \$600,000 for their efforts (Seltz 1976). Seltz also stated that during the same year, North Carolina provided an estimated 15 percent of the national eel export, and the economy received a \$6 million boost from eel-related expenditures. Farin (1972) reported that in Europe and Asia, stable markets exist for elvers as well as for mature eels. He further noted that foreign demand for live and smoked eels has resulted in renewed interest in this important fishery. Berg et. al. (1975) found a year-round eel fishery to exist in the coastal areas of North and South Carolina. As early as 1945, Firth reported that the United States eel fishery extended from Maine to North Carolina and that the annual catch of more than a million pounds was valued at approximately \$100,000 at that time. At today's prices, eel fishing can be a profitable enterprise.

From 1960 through 1970, yearly landing of eels in North Carolina averaged 39.3 thousand pounds, valued at \$1.9 thousand. Average price per pound was \$.05 during that time, and increased to an average \$.16 per pound in 1971 and 1972. From 1973-76, landings averaged 333,307 pounds per year, with an average value of \$.42 per pound (Easley and Freund 1977). During 1979, local buyers in southeastern Louisiana were paying \$.60 per pound for live eels.

American eels have recently showed signs of becoming an important commercial fishery in South Carolina. Export of eels to Europe and the Orient is increasing yearly. American eel stock is being used to supplement an increasing, though still largely foreign, demand for eels (Harrell 1977.) Demand for eels in 1972 was 24,000 tons for Europe; 25,000 tons for Japan; and 5 to 10 tons for Central Europe, the Soviet Union, and China (Jurgensen and Crow 1977). The demand for eels has increased, and over-exploitation of this resource has reduced natural

has resulted in overseas dealers offering fishermen in the U.S. and Canada good prices for eels (McCord 1977).

Recent activity in the eel market prompted some local seafood wholesalers to examine the potential for marketing Louisiana eels. From sampling efforts by private interests, some information was gathered on the availability of eel stocks in the southeastern portion of coastal Louisiana. These preliminary samples indicated a sufficient supply of eels to encourage investigation into the possibility of establishing an active eel fishery in this state. Because there has been no eel fishery in Louisiana or in any other Gulf Coast state, no regulations have yet been established for such a fishery. The Louisiana Wildlife and Fisheries Commission passed a resolution on March 21, 1978, to allow eel fishing in the state on a special permit basis. Since that time, 34 permits have been issued.

Prior to this study, no data were available on eels in Louisiana waters. This study was particularly timely because the fishery is just beginning, and the only information available to prospective fishermen is from studies on Atlantic Coast states. The results of this study should provide much-needed information for the establishment of a viable fishery management program.

AREA DESCRIPTION

The study area was located in southeastern coastal Louisiana, north and east of the Mississippi River Gulf Outlet (Figure 1). This area includes portions of St. Tammany, Orleans, and St. Bernard parishes. To effectively determine optimal environmental conditions for eels, three general areas were selected (Figure 1). The principal difference among the selected areas was salinity range. Area No. 1 was located in St. Tammany Parish along the lower portion of the Pearl River system. Water depths at this location are greatly affected by rainfall and to some extent by tidal level. Depths range from 5 to 30 ft., and water current is generally strong. Salinities in this area ranged from 0-1 part per thousand (ppt), and turbidity levels were generally high. Area No. 2 was located in Orleans Parish in the vicinity of Chef Menteur Pass. Water levels in this area are influenced primarily by tidal action and to a lesser degree by rainfall. Depths range from 5-30 ft., and currents were moderate to strong at most times. During tidal changes, water movement was slack for short periods of time. Salinities in this area range from 2-10 ppt, and turbidity levels were moderate. Area No. 3 was located in St. Bernard Parish in the vicinity of Bayou LaLoutre. This station included areas of broken marsh and extensive bayou systems. Water levels in this area are affected primarily by tidal action and, on rare occasions, by rainfall. Depths range from 5-15 ft., and currents, although slight to moderate, were slack during tidal change. Salinity range was from 5-25 ppt, and turbidity levels were slight to moderate.

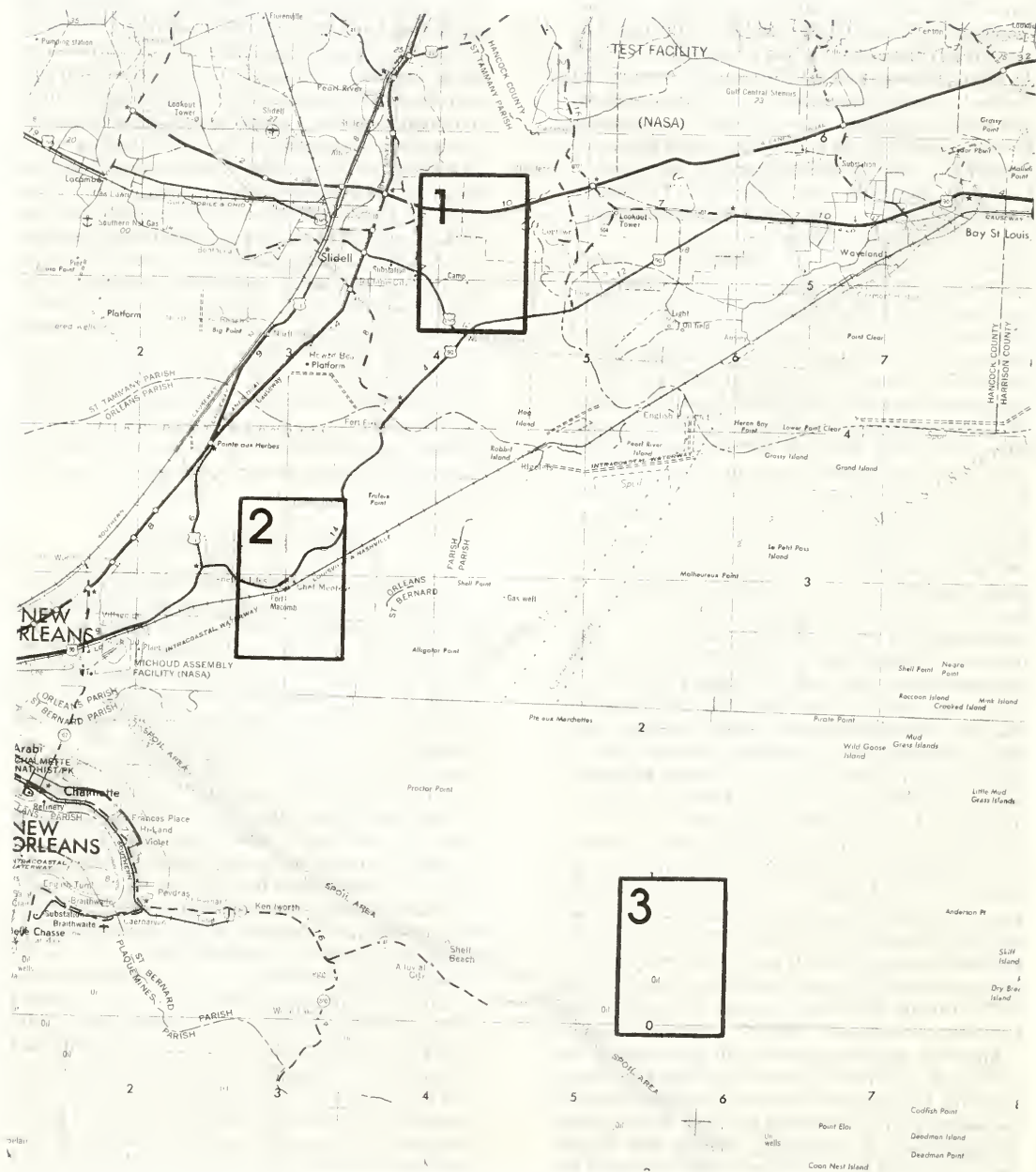


Figure 1. Sampling locations.

MATERIALS AND METHODS

Eels were collected in locally designed commercial-type traps (Figure 2). These traps are cubical, and measure 17 in. (43.18 cm) along all sides. They are constructed of 0.5 x 1 in. (1.27 x 2.54 cm) vinyl-coated wire mesh. Entrance is gained through two parallel funnel openings near the bottom of the trap. These funnels measure 5 in. (12.7 cm) across the front and 2 in. (5.08 cm) across the back. The trap is divided into upper and lower sections by an inverted V-shaped layer of vinyl-coated wire mesh. This layer contains two cylindrical openings that measure 2 in. (5.08 cm) in diameter and extend 3 in. (7.62 cm) towards the top of the trap, allowing access to the upper section. A 4x4x4.5 in. (10.16x10.16x11.43 cm) high bait box is positioned near the center of the lower compartment and has a hinged door for easy accessibility. The top of the trap has a hinged door at one corner to facilitate removal of eels. A treated nylon line is used to fasten the trap to a stationary object.

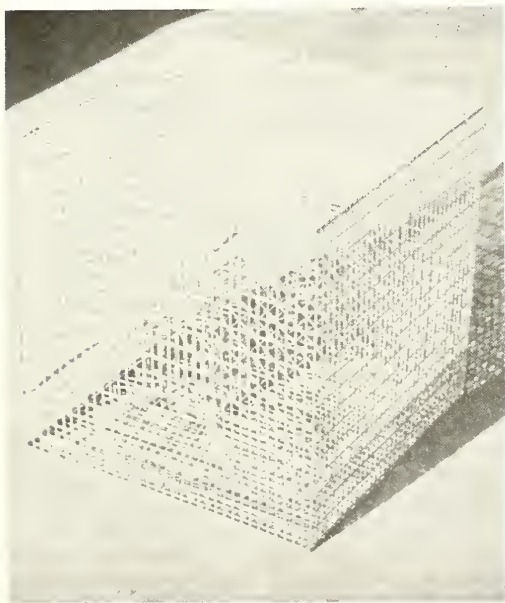


Figure 2. Eel trap used during this project.

Each of the three study areas was sampled twice monthly. Six traps were set in each area and retrieved after 24 hours. Traps were set in pairs, with one of each pair baited with fresh-frozen shrimp heads, and the other with fresh-frozen cracked crab. Upon retrieval, all species were removed and catalogued by individual trap. Samples were packed in ice in the field and transported to the lab for analysis.

Data recorded from each trap included bait type, individual length of eels to the nearest 5 mm grouping, individual weight of eels to the nearest ounce, total number of each incidental species, and total

weight of each incidental species.

Hydrological parameters were recorded as each trap was set and at the time of retrieval. Salinities and water temperatures were recorded utilizing a Beckman RS-5 salinometer. Turbidity was measured with a Secchi disc; wind speed was measured with a hand-held anemometer; and air temperature was measured with a thermometer. Additionally, date, time of day, cloud cover, water depth, and wind direction and speed were recorded.

BIOLOGY

Field sampling for American eel (*Anguilla rostrata*) began April 1, 1979, and continued through March 31, 1981. During the sampling period, a total of 864 traps were set; 11 traps were lost during the study. Catch data were recorded from the 853 traps retrieved. Data collected revealed a total catch of 626 eels having a total weight of 358.4 pounds (162.9 kg) (Table 1). Analysis of these data showed a calculated catch per effort (C/E) of 0.7 eels (Figure 3) per trap per 24 hr. sampling period. Average monthly C/E at all locations using both bait types revealed that catches of eels varied greatly. The most productive period was from November 1979 through March 1980. The least productive period occurred from July through September 1980 (Figure 3). During the study period, monthly C/E of eels reached or exceeded the overall average C/E during 12 months, while monthly C/E also fell below the overall average C/E during 12 months (Figure 3). C/E during summer months (June-August) of both 1979 and 1980 was well below the project average.

Of the 853 traps retrieved, 422 had been baited with shrimp heads, and 431 had been baited with cracked crab. Traps baited with shrimp heads accounted for 466 of all eels caught and revealed a calculated C/E of 1.1 eels (Table 2). There were 160 eels taken in traps baited with cracked crab, for a calculated C/E of 0.4 eels (Table 2). These data clearly show that shrimp bait produced larger numbers of eels during this study. Monthly catches of eels, by bait type, are also presented in Table 2. Traps baited with shrimp heads out-fished those baited with cracked crab during every month except July 1980 (Table 2). The largest monthly catch was recorded from traps baited with shrimp heads during December 1979. When monthly C/E was plotted by bait type, the same pattern was observed. Monthly C/E using shrimp heads exceeded C/E from traps using cracked crab during every month except July 1980. During that month, C/E in traps baited with cracked crab was twice as high as the C/E recorded from those baited with shrimp heads. Traps baited with shrimp produced a monthly C/E at least twice as large as those baited with crab during all other months sampled. Highest monthly C/E for shrimp bait occurred in December 1979, when an average of 3.9 eels were

taken per trap (Figure 4). Highest monthly C/E for crab bait was during March 1980, when an average of 0.8 eels per trap was recorded (Figure 5).

Of the three locations sampled (Figure 1), area 2 produced the most eels. A total of 361 eels were collected at this site from 286 traps, giving an average C/E of 1.3 (Table 3). Eels taken from this area represented 57.7% of the total eel catch. When monthly C/E was plotted against the areal C/E (Figure 6), numbers of eels varied greatly throughout the study period. The most productive months were November 1979 through March 1980. During that period, catches were considerably greater than the areal C/E (Figure 6). In November and December 1981, catches again exceeded the average C/E, but to a lesser degree. All other months during the project revealed catches at or well below the areal C/E, with the period of June through August being the poorest in both 1979 and 1980 (Figure 6).

Area 1 accounted for the second highest catch, with 158 eels taken in 282 traps, representing 25.2% of the total catch, and an areal C/E of 0.6 eels (Table 3). Catches at this location did not vary from the areal C/E as much as in area 2 (Figure 7). Highest C/E at this station occurred in May of both 1979 and 1980, when the C/E exceeded one eel per trap. Monthly C/E fell below the areal C/E during 15 months, while numbers exceeded the areal C/E during only nine months (Figure 7).

Area 3 exhibited the poorest catch, with only 107 eels (Table 3) being taken from 285 traps, representing 17.1% of the total catch, and an areal C/E of 0.4. Catches from this location, like those recorded from area 1, did not vary greatly from the areal C/E (Figure 8). The C/E exceeded one eel per trap only during the months of April 1979 and June 1980 (Figure 8). During every other month sampled, catches were well below one eel per trap.

Numbers of eels collected monthly and total weight in ounces, by location, are presented in Table 4. As Table 4 indicates, area 2 produced the most eels, and catches were greater during winter months throughout the project. Although area 3 had the lowest catch rate, the eels collected at this location did exhibit the largest average size. Eels taken from area 3 averaged 11.3 ounces (320.9 g), while calculated average weights from areas 1 and 2 were 8.8 ounces (249.9 g) and 8.7 ounces (247.1 g), respectively. The average weight of eels calculated from all locations was 9.2 ounces (261.3 g). Average weight of eels taken, by month, is presented in Figure 9. When the average monthly weight of eels was calculated by bait type (Table 5), little difference was observed between catches. Although individual monthly averages varied (Figures 10 and 11), the overall average weight was 9.2 ounces (261.3 g) for each bait type. These data indicate that of the two bait types used during this study, neither one was more selective than the other regarding size of eels captured. Number of eels taken monthly and total weight, by each bait type, are presented in Table 6.

The individual length of each eel captured was also recorded. Eels ranged in total length from 12 in. (305 mm) to 29.5 in. (750 mm), with a mean length of 19.4 in. (492.2 mm).

All other species trapped were also catalogued (Table 1). Although other species were captured, all of these animals could be released unharmed from the traps. During the study, all traps were set and emptied within a 24 hr. period, and using this schedule, it was observed that all organisms collected were still alive and in excellent condition when the traps were emptied.

Catch data showed a total of 34 incidental species (Table 1) taken in eel traps. These species accounted for 3,280 individuals and had a total weight of 422.6 lbs. (191.9 kg). The blue crab was the most prevalent organism, with a total catch of 1,377 specimens and a total weight of 167.7 lbs. (76.1 kg). Blue crabs accounted for 41.9% of the incidental catch by numbers of individuals and 39.7% by weight. Other commercially important species captured included pond crawfish, river shrimp, stone crab, channel catfish, yellow bullhead, mangrove snapper, sheepshead, Atlantic croaker, sand seatrout, and southern flounder. Numbers and total weight of these species are presented in Table 1. Additionally, several species of freshwater game fishes were encountered, including orange spotted sunfish, longear sunfish, bluegill, warmouth, redear, rock bass and white crappie (Table 1).

The largest incidental catch was taken from area 3, with 1,773 individuals (Table 7) and a total weight of 233.6 lbs. (106.1 kg). Catches from this location represented 54.1% of the total incidental catch and 55.3% by weight. Area 2 yielded the second largest incidental catch (Table 7) with 873 specimens weighing 115.3 lbs. (52.4 kg). Area 1 followed, with 643 individuals weighing 73.6 lbs. (33.4 kg) (Table 7).

It should also be noted that shrimp bait, which produced the greatest number of eels, also yielded the largest incidental catch (Table 8), with a total of 2,001 individuals having a total weight of 269.6 lbs. (122.4 kg). Only 1,279 specimens, weighing a total of 153 lbs. (69.5 kg) (Table 8), were recorded from incidental catch taken in traps baited with cracked crab.

Table 1.

Systematic List of Species Caught in Eel Traps from April 1, 1979—March 31, 1981 by Bait Type, Showing Number Caught and Total Weight in Pounds.

	BAIT TYPE			
	Shrimp		Crab	
	Total No.	Total Wt.	Total No.	Total Wt.
Class Crustacea				
Order Decapoda				
Family Astacidae				
<i>Procambarus blandingi</i> (Girard)—Pond crawfish	12	0.8	18	1.1
Family Palaemonidae				
<i>Macrobrachium ohione</i> (Smith)—River shrimp	26	1.1	22	0.9
Family Portunidae				
<i>Callinectes sapidus</i> (Rathbun)—Blue crab	869	107.7	508	60.0
Family Xanthidae				
<i>Menippe mercenaria</i> (Say)—Stone crab	3	1.1	2	0.1
<i>Rhithropanopeus harrisi</i> (Gould)—Mud crab	2	1.1	2	0.1
Class Osteichthyes				
Order Anguilliformes				
Family Anguillidae				
<i>Anguilla rostrata</i> (Lesueur)—American eel	466	266.9	160	91.5
Family Ophichthidae				
<i>Ophichthus gomesi</i> (Castelnau)—Shrimp eel	1	0.3	—	—
Order Cypriniformes				
Family Cyprinidae				
<i>Pimephales vigilax</i> (Baird and Girard)—Bulhead minnow	99	3.0	139	6.7
Order Siluriformes				
Family Ictaluridae				
<i>Ictalurus punctatus</i> (Rafinesque)—Channel catfish	30	5.8	21	3.7
<i>Ictalurus natalis</i> (Lesueur)—Yellow bullhead	11	5.1	4	1.3
<i>Noturus gyrinus</i> (Mitchill)—Tadpole madtom	2	0.2	—	—
Family Ariidae				
<i>Arius felis</i> (Linnaeus)—Sea catfish	347	58.3	122	20.5
<i>Bagre marinus</i> (Mitchill)—Gafftopsail catfish	1	0.3	1	0.1
Order Atheriniformes				
Family Cyprinodontidae				
<i>Fundulus grandis</i> (Baird and Girard)—Gulf killifish	50	2.7	1	0.1
Order Batrachoidiformes				
Family Batrachoididae				
<i>Opsanus beta</i> (Goode and Bean)—Gulf toadfish	17	4.8	21	5.3
Order Perciformes				
Family Centrarchidae				
<i>Lepomis humilis</i> (Girard)—Orange spotted sunfish	18	4.5	15	2.8
<i>Lepomis megalotis</i> (Rafinesque)—Longear sunfish	111	12.8	81	7.3
<i>Lepomis macrochirus</i> (Rafinesque)—Bluegill	154	14.7	71	6.3
<i>Lepomis gulosus</i> (Cuvier)—Warmouth	10	2.0	15	1.5
<i>Lepomis microlophus</i> (Günther)—Redear	1	0.3	1	0.2
<i>Ambloplites rupestris</i> (Rafinesque)—Rock bass	16	2.0	14	1.8
<i>Pomoxis annularis</i> (Rafinesque)—White crappie	—	—	3	0.4
Family Lutjanidae				
<i>Lutjanus griseus</i> (Linnaeus)—Mangrove snapper	1	0.2	1	0.1
Family Pomadasyidae				
<i>Orthopristis chrysoptera</i> (Linnaeus)—Pigfish	1	0.2	—	—
Family Sparidae				
<i>Logodon rhomboides</i> (Linnaeus)—Pinfish	60	8.4	79	9.7
<i>Archosargus probatocephalus</i> (Walbaum)—Sheepshead	114	15.9	59	8.8

Family Sciaenidae				
<i>Micropogonias undulatus</i> (Linnaeus)—Atlantic croaker	18	6.3	20	5.5
<i>Cynoscion arenarius</i> (Ginsburg)—Sand seatrout	1	0.8		
<i>Bairidella chrysura</i> (Lacepede)—Silver perch	4	0.8	3	0.7
Family Ehippidae				
<i>Chaetodipterus faber</i> (Broussonet)—Atlantic spadefish	—	—	8	0.7
Order Pleuronectiformes				
Family Bothidae				
<i>Paralichthys lethostigma</i> (Jordan and Gilbert)—Southern flounder	1	0.1	1	0.1
Family Soleidae				
<i>Trinectes maculatus</i> (Bloch and Schneider)—Hogchoker	1	0.1	—	—
Order Tetraodontiformes				
Family Tetraodontidae				
<i>Sphoeroides nephelus</i> (Goode and Bean)—Southern puffer	17	1.1	41	2.9
Class Amphibia				
Order Urodela				
Family Proteidae				
<i>Necturus maculosus</i> (Rafinesque)—Gulf Coast Waterdog	2	0.4	—	—
<i>Amphiuma tridactylum</i> (Cuvier)—Three-toed amphiuma	—	—	2	3.5
Class Reptilia				
Order Chelonia				
Family Kinosternidae				
<i>Sternotherus odoratus</i> (Latreille)—Stinkpot	3	0.9	1	0.1

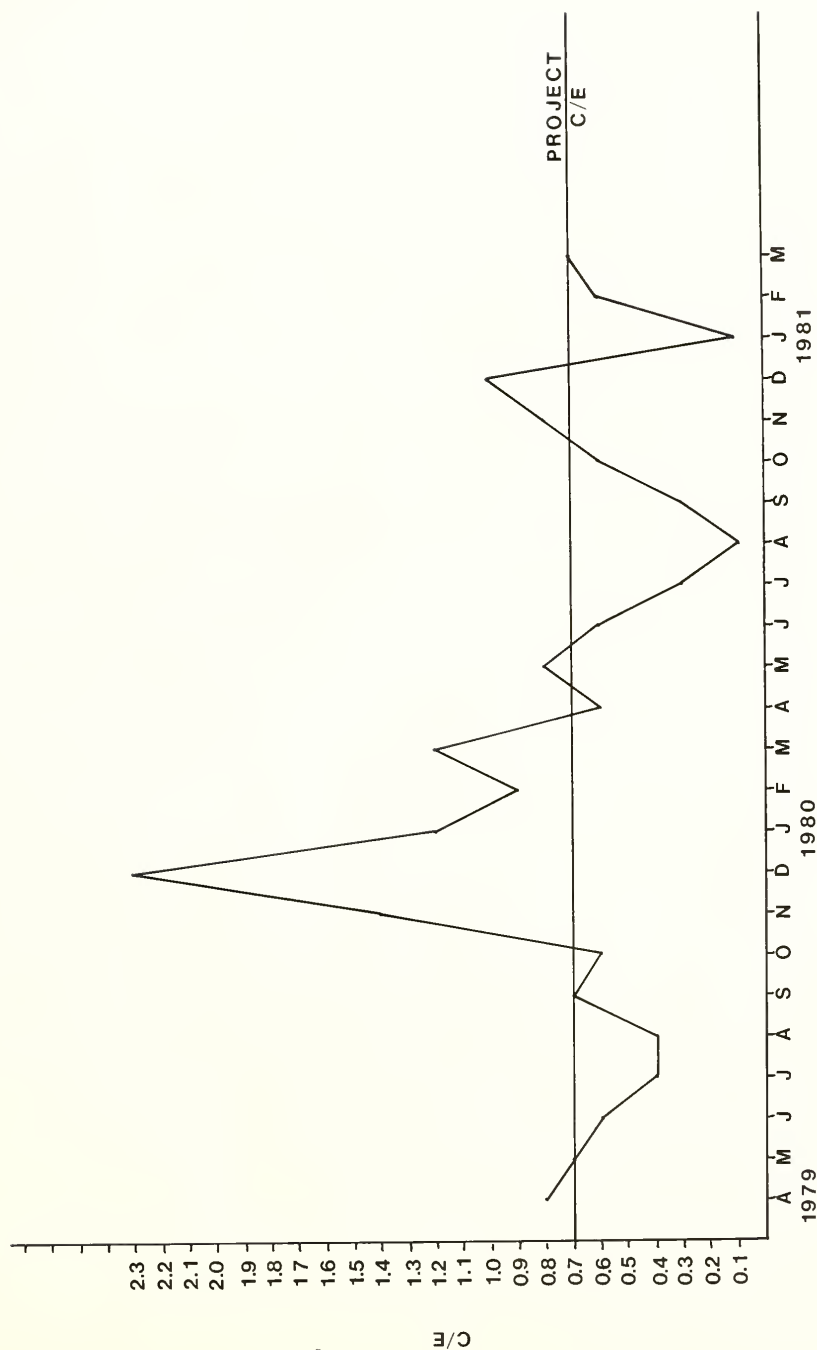


Figure 3. Monthly catch per effort (C/E) of American eel (*Anguilla rostrata*) for all locations and bait types, as compared to the project C/E.

Table 2.
Monthly fishing effort, number of eels caught, and catch per effort (C/E), by bait type.

Year/ Month	Fishing Effort*	Shrimp Bait		Fishing Effort*	Crab Bait	
		No. of Eels	C/E		No. of Eels	C/E
1979						
April	17	20	1.2	18	8	0.4
May	11	16	1.5	20	6	0.3
June	18	15	0.8	18	9	0.5
July	18	10	0.6	17	5	0.3
August	18	11	0.6	18	3	0.2
September	18	15	0.8	18	9	0.5
October	18	13	0.7	18	10	0.6
November	18	40	2.2	18	12	0.7
December	18	70	3.9	18	12	0.7
1980						
January	18	29	1.6	18	13	0.7
February	18	30	1.7	18	3	0.2
March	18	29	1.6	18	14	0.8
April	18	16	0.9	18	4	0.2
May	18	17	0.9	18	11	0.6
June	18	17	0.9	18	3	0.2
July	18	3	0.2	18	8	0.4
August	18	4	0.2	18	0	0
September	18	9	0.5	17	0	0
October	18	16	0.9	17	6	0.4
November	18	20	1.1	18	9	0.5
December	17	30	1.8	18	6	0.3
1981						
January	18	2	0.1	18	0	0
February	18	15	0.8	18	5	0.3
March	17	19	1.1	18	4	0.2
TOTALS	422	466	1.1	431	160	0.4

*One fishing effort is equivalent to one trap retrieved after a 24 hour period.

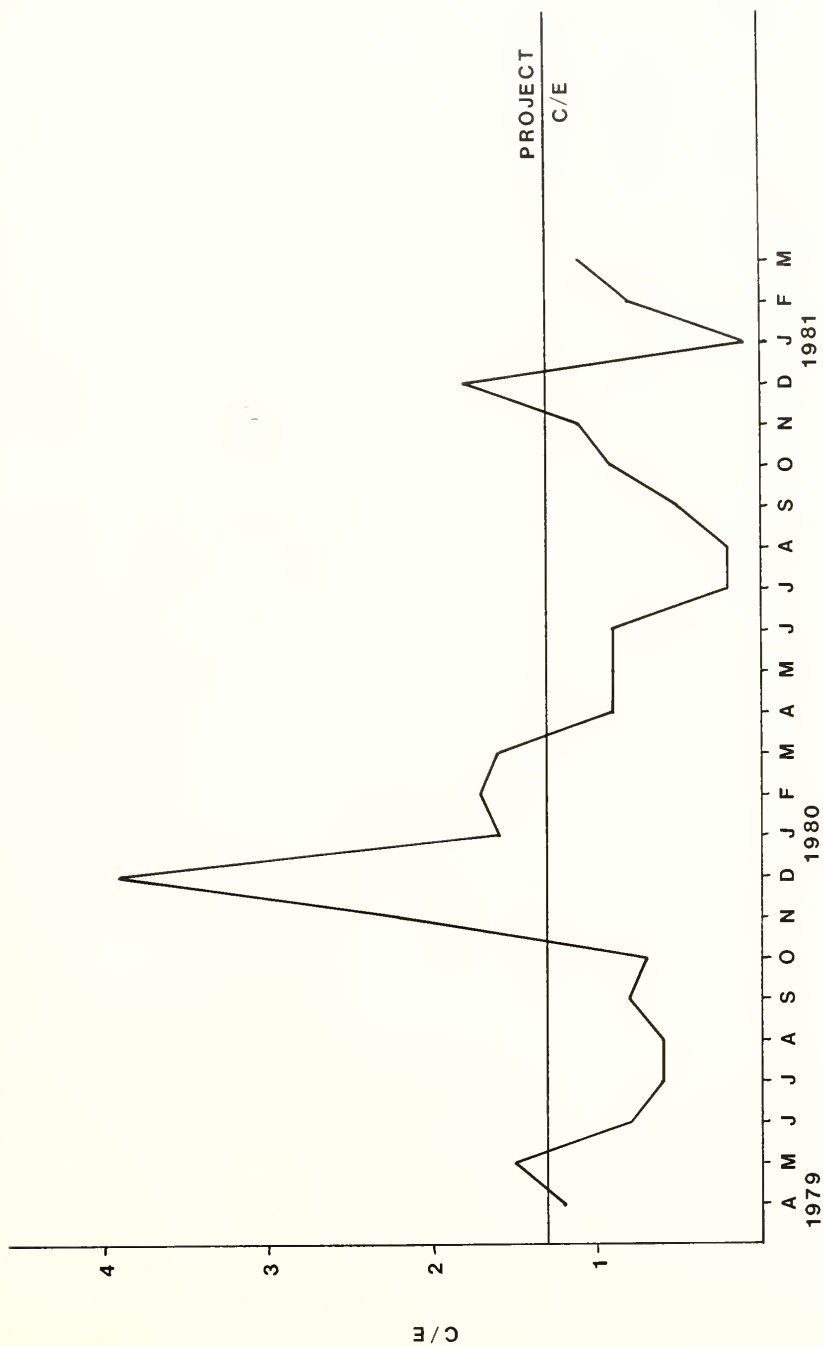


Figure 4. Monthly catch per effort (C/E) of American Eel (*Anguilla rostrata*) for traps baited with shrimp heads, as compared to the project C/E for that bait type.

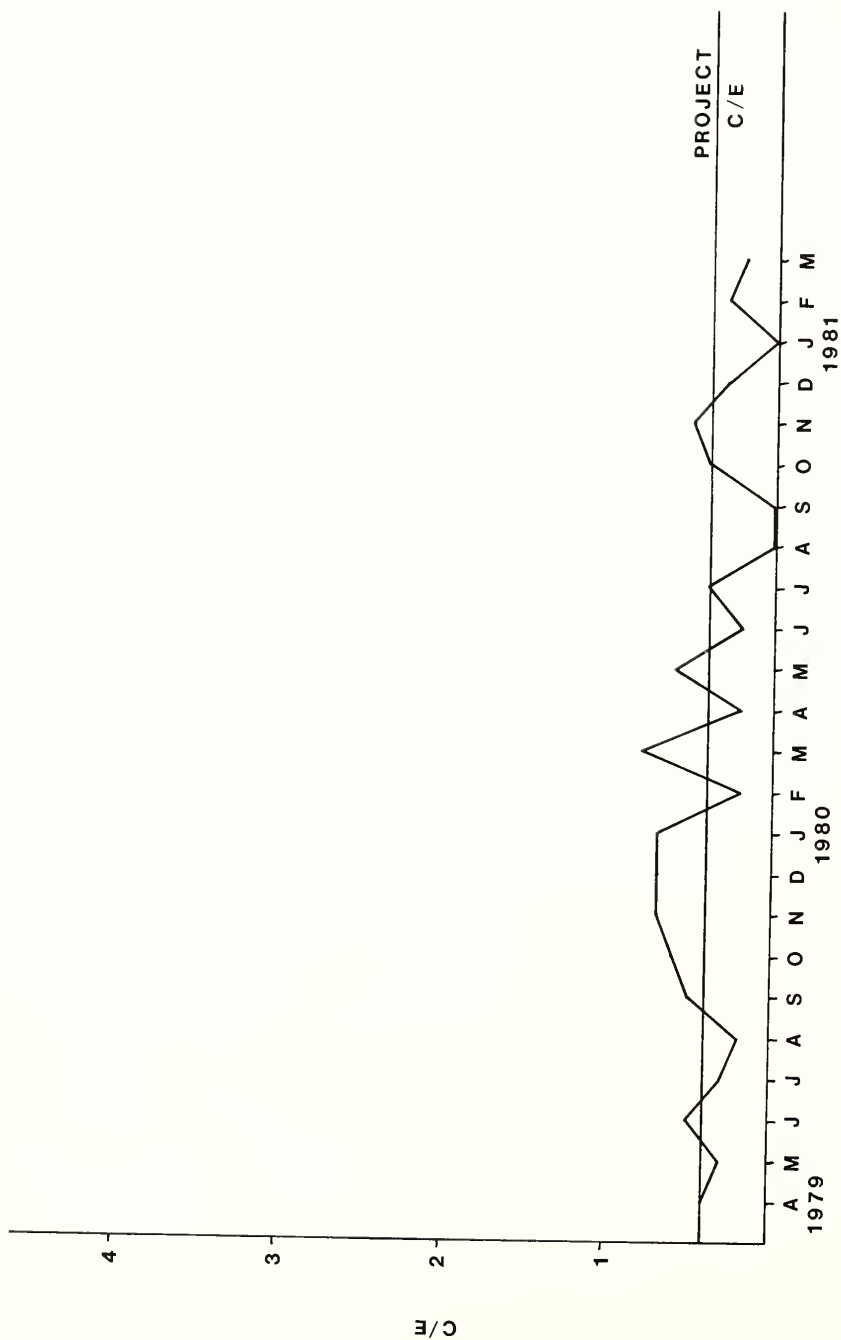


Figure 5. Monthly catch per effort (C/E) of American eel (*Anguilla rostrata*), for traps baited with cracked crab, as compared to the project C/E for that bait type.

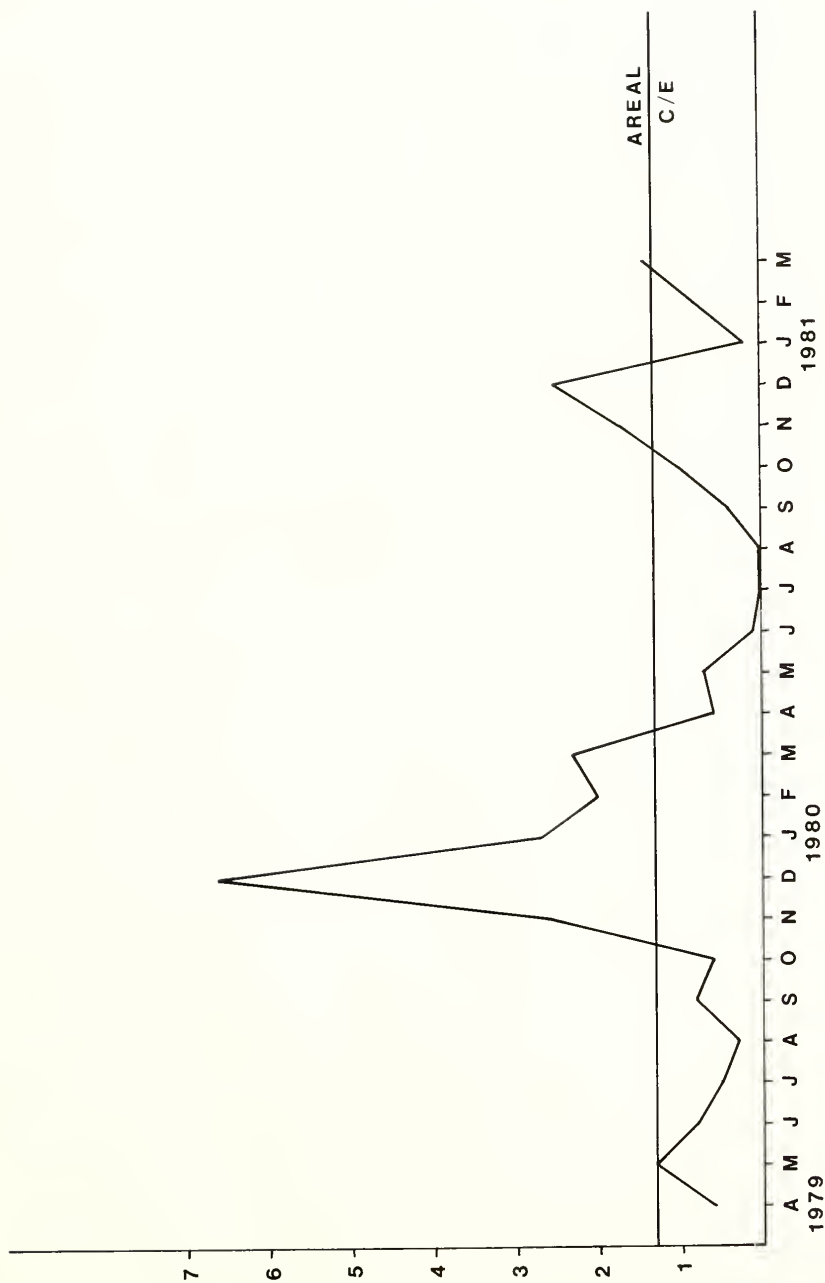


Figure 6. Monthly catch per effort (C/E) of American eel (*Anguilla rostrata*), from area 2, as compared to the areal C/E for that location.

Table 3.

Monthly fishing effort, number of eels caught, and catch per effort (C/E), by location.

Year/ Month	Area 1			Area 2			Area 3		
	Fishing Effort*	Eels	C/E	Fishing Effort*	Eels	C/E	Fishing Effort*	Eels	C/E
1979									
April	12	4	0.3	11	7	0.6	12	17	1.4
May	7	6	1.2	12	15	1.3	12	1	0.1
June	12	8	0.7	12	10	0.8	12	6	0.5
July	11	6	0.5	12	6	0.5	12	3	0.3
August	12	7	0.6	12	3	0.3	12	4	0.3
September	12	12	1.0	12	9	0.8	12	3	0.3
October	12	8	0.7	12	7	0.6	12	8	0.7
November	12	6	0.5	12	31	2.6	12	15	1.3
December	12	2	0.2	12	79	6.6	12	1	0.1
1980									
January	12	9	0.8	12	32	2.7	12	1	0.1
February	12	6	0.5	12	24	2.0	12	3	0.3
March	12	12	1.0	12	28	2.3	12	3	0.3
April	12	10	0.8	12	7	0.6	12	3	0.3
May	12	19	1.6	12	8	0.7	12	1	0.1
June	12	6	0.5	12	1	0.1	12	13	1.1
July	12	10	0.8	12	0	0	12	1	0.1
August	12	3	0.3	12	0	0	12	1	0.1
September	12	2	0.2	12	5	0.4	11	2	0.1
October	12	5	0.4	12	12	1.0	11	5	0.5
November	12	3	0.3	12	20	1.7	12	6	0.5
December	12	2	0.2	11	28	2.5	12	6	0.5
1981									
January	12	0	0	12	2	0.2	12	0	0
February	12	7	0.6	12	10	0.8	12	3	0.3
March	12	5	0.4	12	17	1.4	11	1	0.1
TOTALS	282	158	0.6	286	361	1.3	285	107	0.4

*One fishing effort is equivalent to one trap retrieved after a 24 hour period.

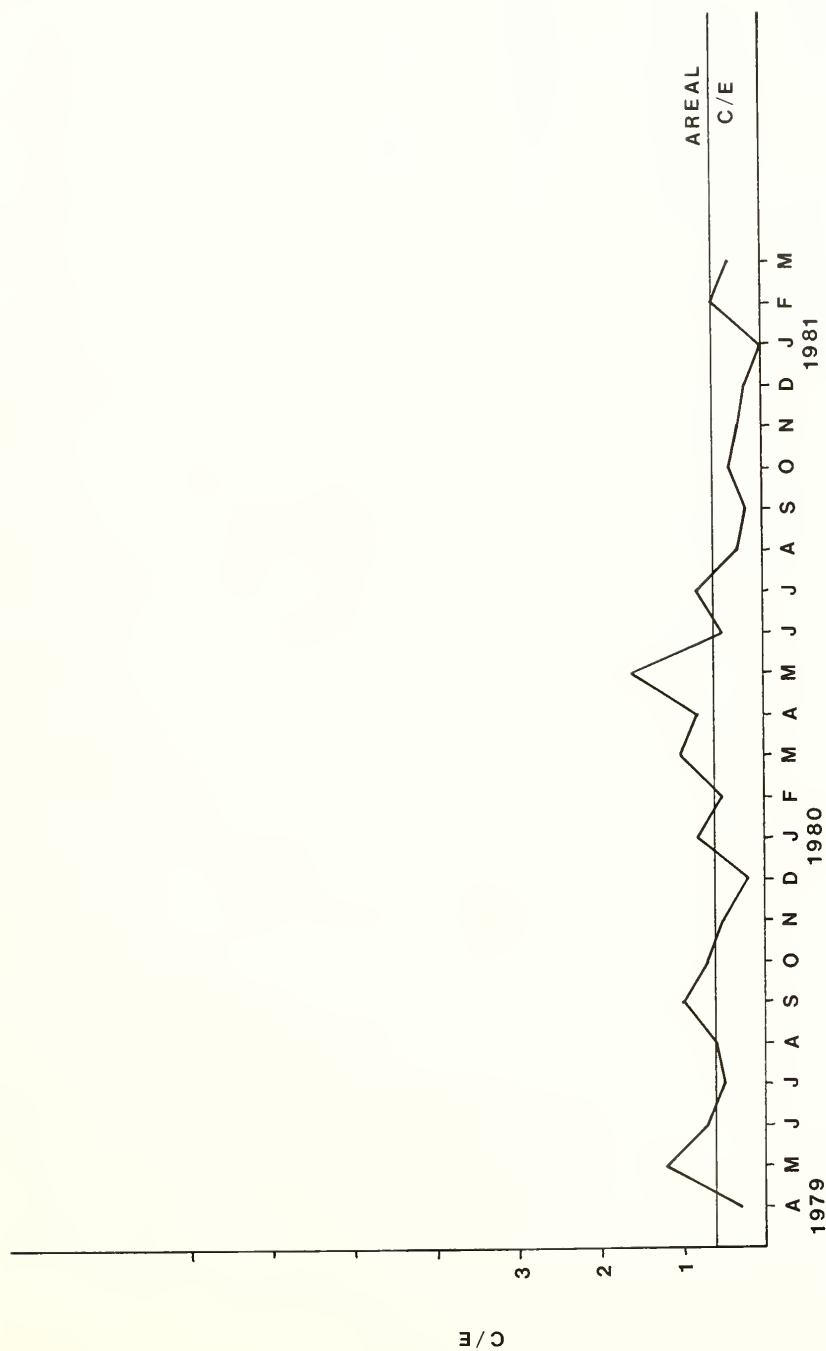


Figure 7. Monthly catch per effort (C/E) of American eel (*Anguilla rostrata*), from area 1, as compared to the areal C/E for that location.

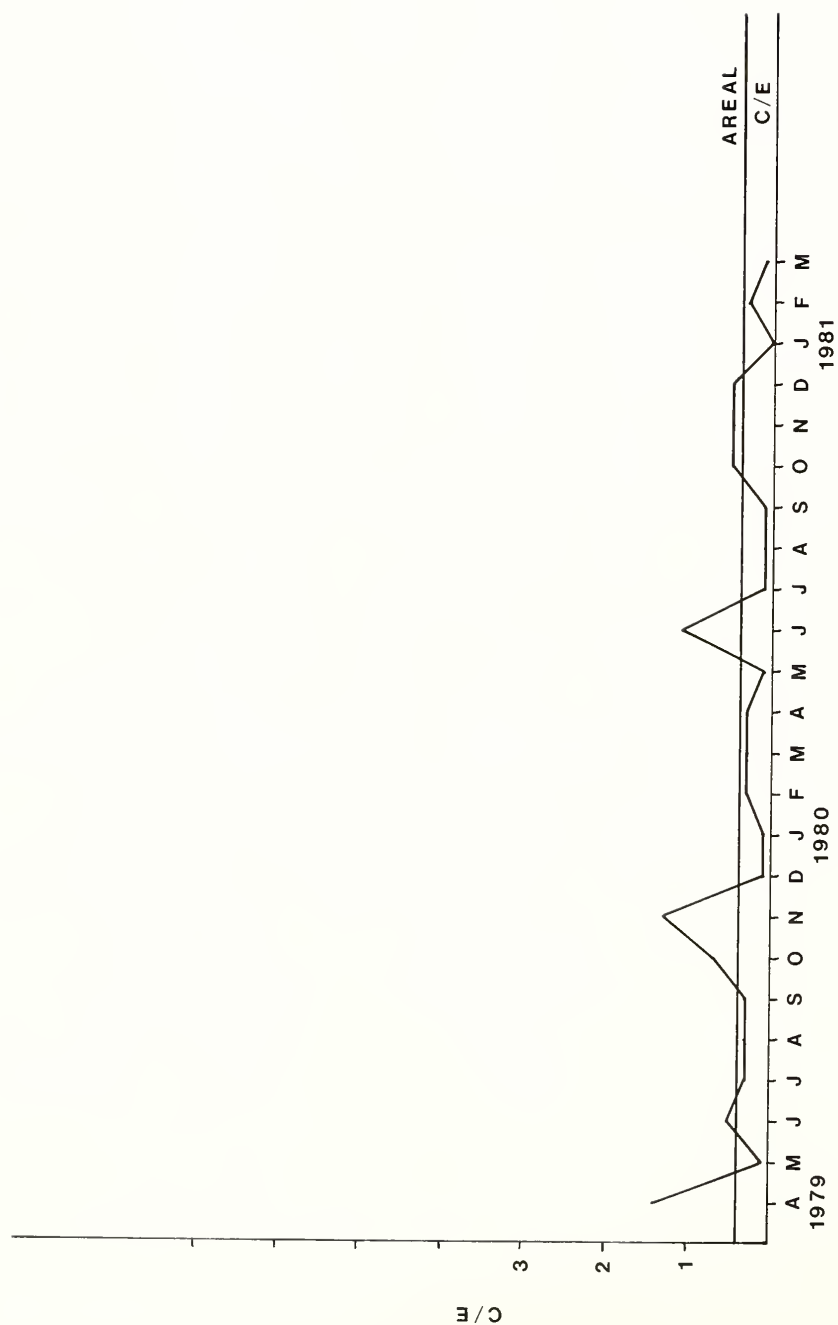


Figure 8. Monthly catch per effort (C/E) of American eel (*Anguilla rostrata*), from area 3, as compared to the areal C/E from that location.

Table 4.
Number of Eels Taken and Weight in Ounces by Month and Location.

Year/ Month	Area 1		Area 2		Area 3	
	Number of Eels	Total Weight	Number of Eels	Total Weight	Number of Eels	Total Weight
1979						
April	4	28	7	35	17	210
May	6	52	15	144	1	11
June	8	59	10	99	6	69
July	6	43	6	57	3	45
August	7	101	3	26	4	41
September	12	119	9	80	3	42
October	8	106	7	67	8	101
November	6	44	31	302	15	141
December	2	22	79	672	1	12
1980						
January	9	100	32	277	1	22
February	6	52	24	186	3	35
March	12	83	28	273	3	29
April	10	40	7	80	3	23
May	19	142	8	48	1	7
June	6	46	1	10	13	175
July	10	122	0	0	1	19
August	3	13	0	0	1	10
September	2	27	5	43	2	27
October	5	27	12	83	5	50
November	3	39	20	183	6	68
December	2	12	28	228	6	35
1981						
January	0	0	2	13	0	0
February	7	79	10	79	3	16
March	5	36	17	154	1	16
TOTALS	158	1,392	361	3,139	107	1,204

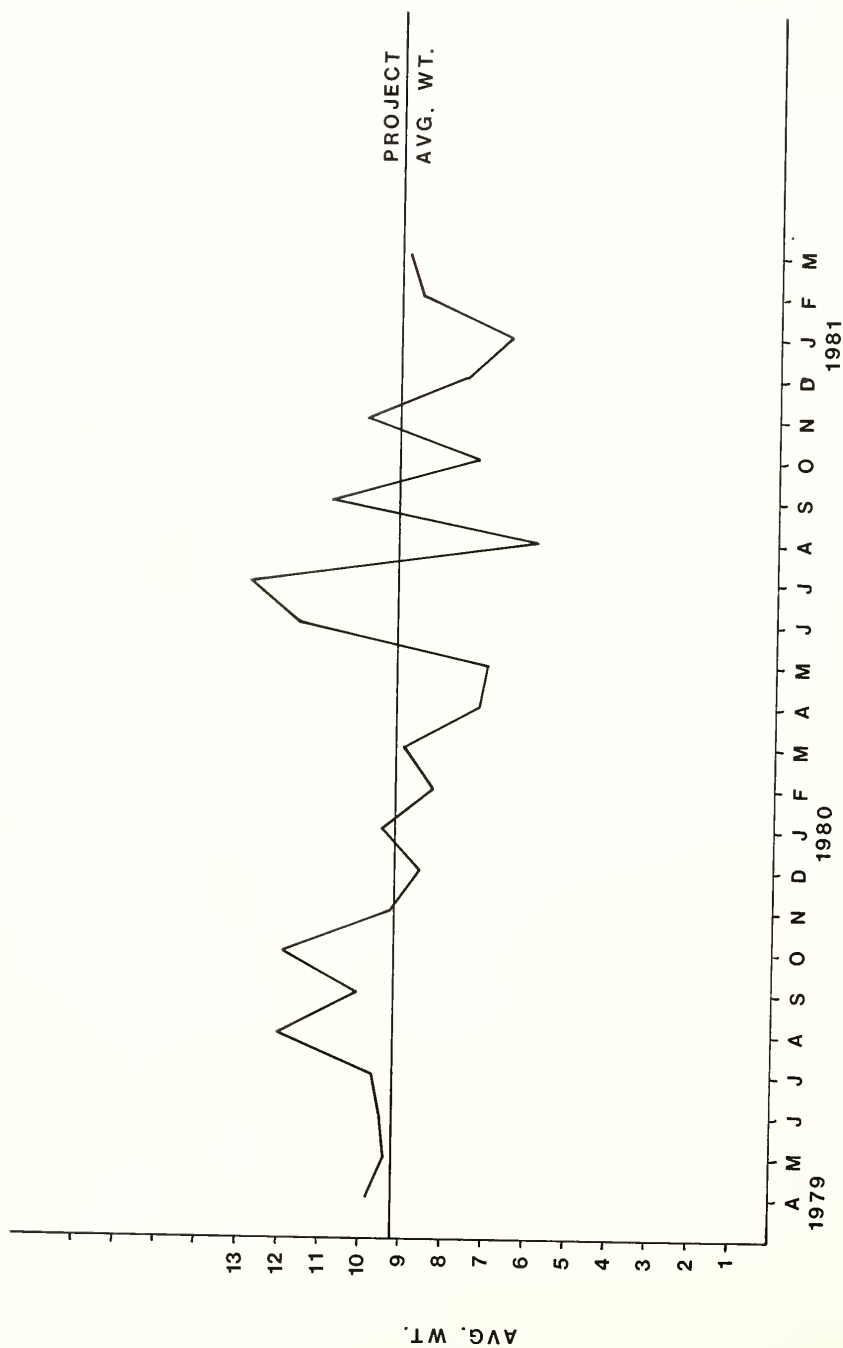


Figure 9. Average weight in ounces of eels taken, by month, as compared to the average weight of all eels collected.

Table 5.
Average Weight of Eels in Ounces by Month and Bait Type.

Year/ Month	Shrimp Bait Average Weight Eels	Crab Bait Average Weight Eels
1979		
April	9.8	11.5
May	9.1	13.3
June	10.1	8.4
July	10.6	5.9
August	12.7	7.8
September	10.0	8.3
October	12.2	8.8
November	10.2	22.7
December	8.7	33.6
1980		
January	9.8	15.8
February	7.9	13.1
March	7.9	12.7
April	6.9	6.2
May	7.2	6.8
June	12.5	11.8
July	16.3	2.7
August	5.8	1.2
September	10.8	5.4
October	7.5	6.7
November	8.6	9.6
December	7.8	13.8
1981		
January	6.5	0.7
February	9.3	7.8
March	8.7	9.7
TOTALS	9.2	9.2

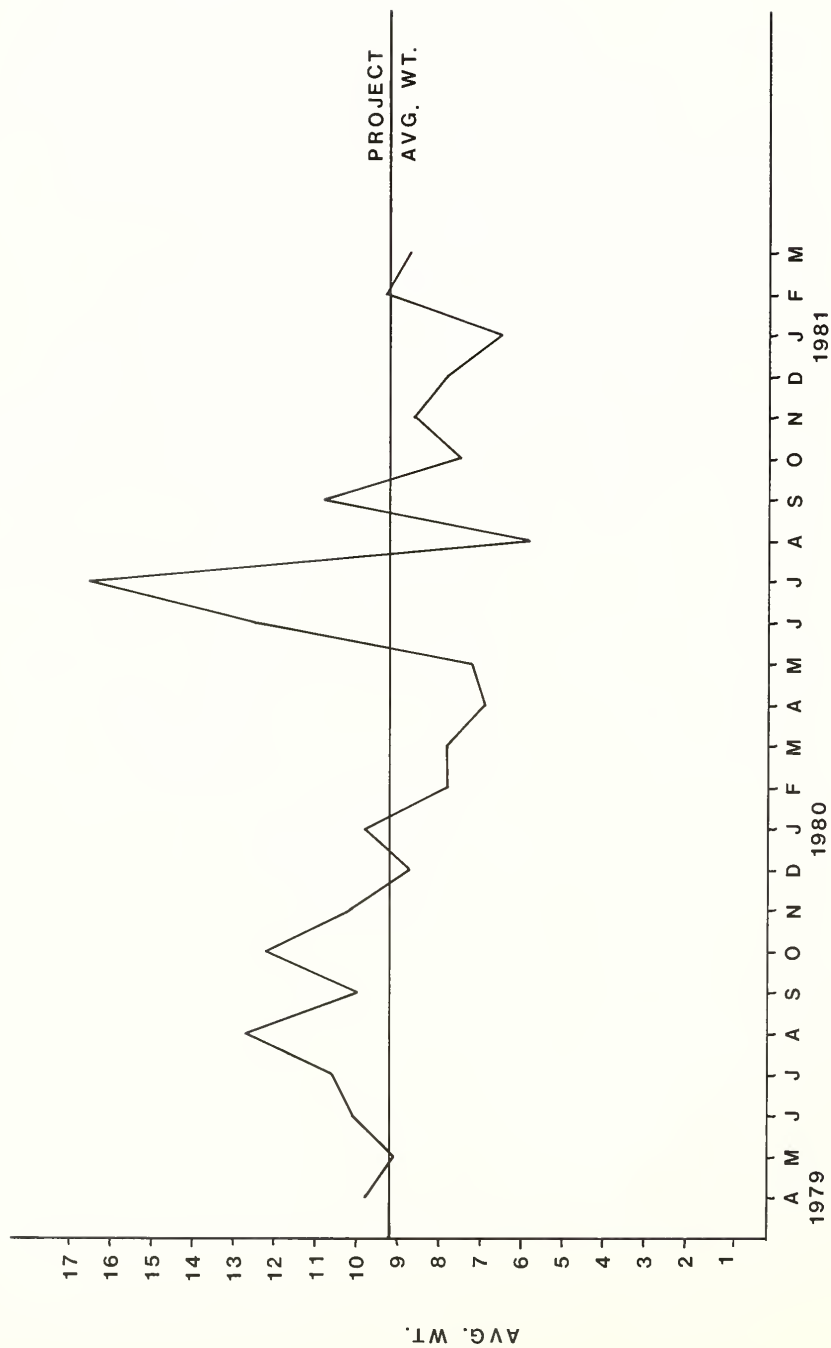


Figure 10. Average weight in ounces of eels, by month, taken with shrimp bait, as compared to the average weight of all eels taken with this bait type.

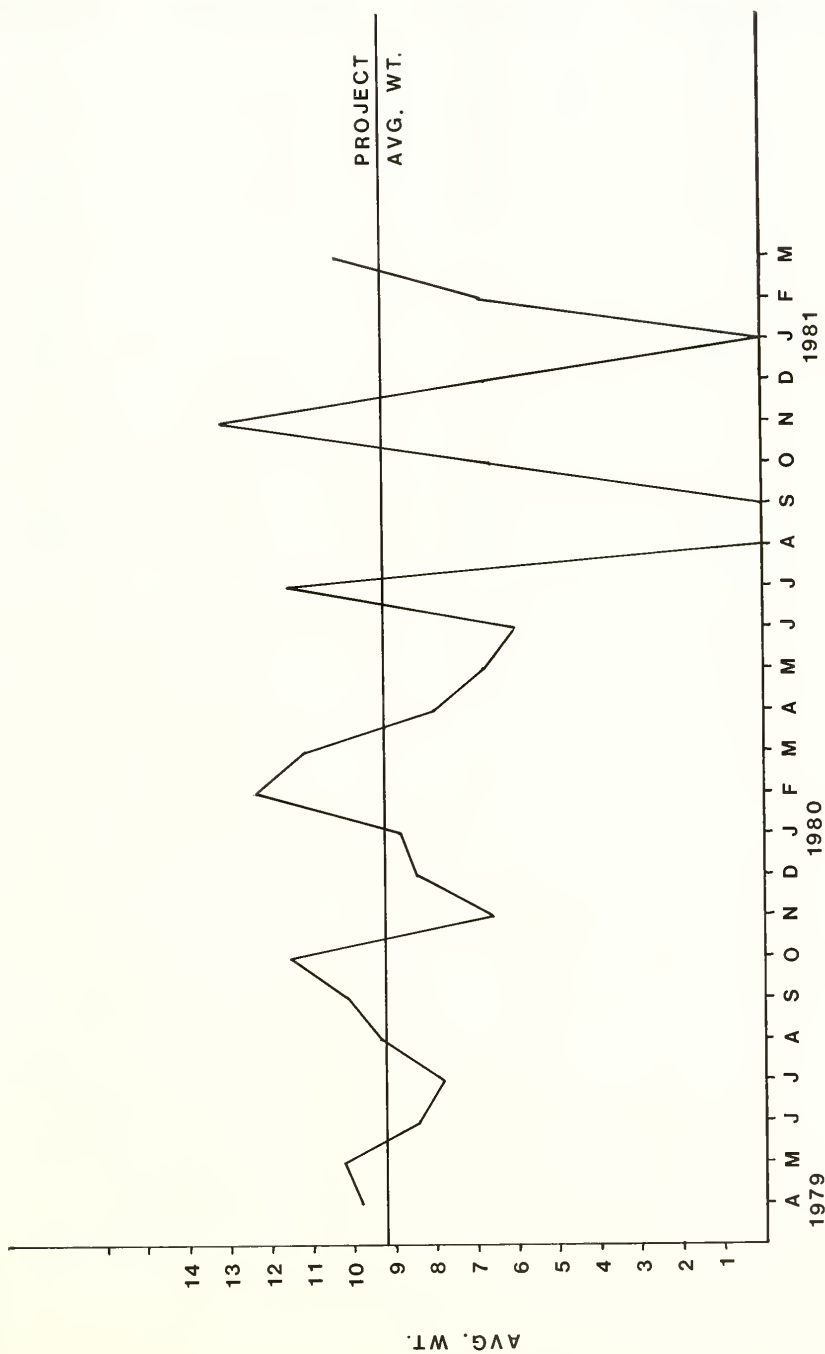


Figure 11. Average weight in ounces of eels, by month, taken with crab bait, as compared to the average weight of all eels taken with this bait type.

Table 7.
Incidental Catch by Number of Individuals, Total Weight in Ounces, Month, and Location.

YearMonth	Area 1		Area 2		Area 3	
	Number of Individuals	Total Weight	Number of Individuals	Total Weight	Number of Individuals	Total Weight
1979						
April	14	16	71	132	54	252
May	26	28	45	120	45	105
June	45	37	48	110	69	153
July	24	24	44	94	70	207
August	38	51	41	77	49	107
September	19	73	47	66	103	226
October	92	139	25	45	73	174
November	83	149	4	14	37	94
December	30	95	13	35	68	100
1980						
January	18	35	37	61	319	290
February	3	9	16	25	79	76
March	8	22	62	141	46	126
April	13	17	53	119	49	165
May	17	32	47	111	90	242
June	30	70	65	155	76	187
July	24	66	58	117	108	229
August	35	77	50	94	130	302
September	26	43	76	153	107	229
October	13	24	17	33	96	274
November	14	30	9	23	28	68
December	22	38	20	69	13	32
1981						
January	16	32	8	14	25	35
February	15	49	8	18	18	30
March	9	22	9	19	21	35
TOTALS	634	1,178	873	1,845	1,773	3,738

Table 8.
Incidental Catch by Number of Individuals, Total Weight in Ounces, Month, and Bait Type.

Year/ Month	Shrimp Bait		Crab Bait	
	Number of Individuals	Total Weight	Number of Individuals	Total Weight
1979				
April	93	314	46	86
May	46	131	70	122
June	83	140	79	160
July	83	204	55	121
July	62	109	66	126
August	116	226	53	139
September	116	245	74	113
October	83	176	41	81
November	81	186	30	33
December				
			157	
1980	217	243	21	143
January	77	82	28	28
February	88	224	52	65
March	63	173	58	128
April	96	237	63	148
May	108	291	77	121
June	113	235	79	177
July	136	321	83	152
August	126	266	40	159
September	86	220	29	111
October	22	59	27	62
November	28	83		56
December				
	38		11	
1981	24	57	17	24
January	16	58	23	39
February		33		43
March	2,001		1,279	
TOTALS		4,313		2,448

HYDROLOGY

Salinity seems to be the primary factor affecting concentrations of eels. During the study period, area 1 consistently had the lowest salinity, always less than 1 ppt; area 2 had an average salinity of 5.5 ppt; and area 3 exhibited the highest salinity, with an average of 11.4 ppt. Average monthly salinities for each location and the corresponding project averages are presented in Table 9. Area 2, which had a moderate salinity, produced by far the most eels. The next highest catch came from area 1, which had the lowest salinity. Area 3 produced the fewest numbers of eels. These data show that within the area sampled, eels were most concentrated in those locations having moderate-to-low salinities.

Water temperature was apparently another important factor affecting eel catches. Average monthly water temperatures varied only slightly among locations (Table 10), however, average temperatures varied significantly from month to month. Eel catches were generally larger during winter months, when

average water temperature was below 25.0°C. Of the eels taken during this study, 77% were captured during months when the average water temperature was lower than 25.0°C. Generally, as average water temperature decreased, C/E of eels increased. During January 1981, however, average water temperature fell to 9.1°C. (Table 10), and the lowest monthly catch of eels throughout the study period was recorded at this time. These data may indicate that eels feed most actively when water temperature is between 10°C and 25°C, and that feeding falls off drastically when water temperature falls below 10°C or exceeds 25°C.

Turbidity was also recorded each time traps were set and retrieved. Monthly average turbidities are presented in Table 11. For each month, the average turbidity by area was compared to the catch of eels. This data did not indicate a direct relationship between turbidity and eel catch. In areas 2 and 3, the turbidities (Table 11) for the study period were nearly identical, yet area 2 produced the greatest number of eels, while area 3 produced the fewest.

Table 9.
Average monthly salinities in parts per thousand (ppt) and project averages, by area.

Year/Month	Area 1 Salinity ppt	Area 2 Salinity ppt	Area 3 Salinity ppt
1979			
April	0	2.6	6.6
May	0	0.7	3.4
June	0	1.4	7.5
July	0.1	3.6	11.3
August	0	4.0	12.4
September	0	3.9	7.9
October	0	6.7	12.8
November	0.1	6.8	12.3
December	0	6.2	10.9
1980			
January	0	3.9	8.5
February	0	3.3	6.7
March	0	3.8	7.7
April	0.1	2.7	3.8
May	0.1	3.0	9.8
June	0.2	2.2	10.9
July	0.1	3.4	15.7
August	0.2	8.7	19.4
September	0.3	9.1	23.1
October	0.3	11.4	16.6
November	0.4	9.0	12.3
December	0.3	8.9	14.4
1981			14.8
January	0.2	9.0	11.8
February	0.3	9.1	14.1
March	0.3	8.4	
AVERAGES	0.12	5.5	11.4

Table 10.
Average monthly water temperatures in degrees centigrade (°C) and project averages by area.

Year/Month	Area 1 Temperature °C	Area 2 Temperature °C	Area 3 Temperature °C
1979			
April	20.7	21.5	23.2
May	23.7	22.2	24.7
June	29.2	28.3	29.8
July	26.3	30.0	31.2
August	30.0	30.6	30.9
September	28.4	25.5	25.0
October	18.7	23.4	22.9
November	9.5	15.9	15.2
December		9.8	10.9
1980	12.0		11.7
January	8.6	11.5	14.6
February	13.4	9.8	18.6
March	17.4	17.3	20.9
April	20.8	19.1	25.4
May	27.9	24.8	30.0
June	28.8	28.5	31.4
July	30.2	30.8	31.3
August	28.8	30.6	29.2
September	20.5	29.1	22.0
October	17.4	20.8	14.9
November	12.7	16.3	17.4
December		14.2	
1982	8.3	8.1	11.0
January	10.9	10.0	14.1
February	15.0	15.5	16.4
March			
AVERAGES	20.0	20.6	21.8

Table 11.
Average monthly turbidity in ft. and project averages, by location.

Year/Month	Area 1 Feet	Area 2 Feet	Area 3 Feet
1979			
April	1.0	1.8	1.6
May	1.1	1.4	1.5
June	1.0	2.4	1.7
July	1.3	1.8	1.7
August	1.5	3.0	2.0
September	1.3	2.4	2.7
October	1.4	3.5	2.1
November	1.7	3.8	3.3
December	1.0	3.4	4.3
1980			
January	1.1	2.2	3.0
February	1.0	1.3	2.5
March	1.0	1.3	2.5
April	1.0	1.6	2.0
May	0.5	1.8	2.2
June	1.0	2.5	2.1
July	1.2	1.6	1.4
August	1.8	3.5	2.4
September	1.0	2.9	1.9
October	1.0	3.2	2.2
November	1.3	3.0	3.4
December	1.2	4.2	3.4
1981			
January	1.6	3.9	4.6
February	1.3	2.0	3.0
March	1.0	3.0	3.2
AVERAGES	1.2	2.6	2.5

DISCUSSION AND RECOMMENDATIONS

The greatest setback encountered in the attempt to establish an eel fishery in Louisiana has undoubtedly been a lack of interest on the part of the local commercial fishermen. Traditionally, shrimp has been the largest and most attractive commercial fishery in this state. Whenever shrimp are plentiful, everyone wants to fish for this species. During poor shrimp seasons or closed season, many shrimpers will fish for other species (i.e., crabs, oysters, and spotted seatrout), but they always return to shrimping when catches improve. Some fishermen actively pursue oysters, crabs or finfish on a full-time basis and will harvest shrimp only during good shrimp seasons. These fishermen will eventually return to their primary fishery when shrimp crops are reduced. The problem with the eel fishery is that no local fishermen have ever made eel fishing their primary goal. It is difficult to communicate to the fishermen that in order to successfully trap eels, one must learn the habits and tendencies of the species and actively fish on a continuing basis. The lack of full-time eel fishermen, therefore, leads directly to a second critical limiting factor in the development of any fishery. That factor is the establishment of a stable local market for the product.

When eel fishing was first proposed in Louisiana, several wholesale seafood buyers indicated an interest in handling the product. However, after a relatively short period, these buyers found that because of the lack of interest shown by local fishermen and poor catches by those fishermen who did attempt eel fishing, they were unable to obtain sufficient quantities of eels to warrant handling the product. Without local buyers, the eel fishery has virtually collapsed in Louisiana. Some wholesalers insist that they will buy eels if they can obtain sufficient quantities, but fishermen will not trap eels unless they can be assured that buyers will handle whatever they bring, however small the quantity. The fishery is therefore caught in a no-win situation. The fishermen will not fish without a market, and the buyers cannot create a market without the fishermen.

Another significant problem is the expense involved in entering the eel fishery. Traps are very expensive, and equipment necessary for keeping eels alive is generally out of financial reach for most local fishermen. Buyers are also reluctant to spend the necessary funds to construct holding tanks and freezers capable of "quick freezing" the live eels. These freezing units are essential since improper freezing renders the eels virtually worthless. Holding tanks are also necessary because the eels must be kept alive until they can be separated by size, packaged, and "quick frozen".

Data collected during this study did not indicate the presence of a sufficient number of eels to constitute a potential for the development of an eel fishery

in this portion of the state. Of the three locations sampled (Figure 1), only area 2 revealed a sufficient concentration of eels to possibly support a limited fishery. In addition to the samples taken within the study area, a limited amount of eel sampling was conducted by Department biologists throughout coastal Louisiana. These data also failed to indicate a sufficient number of eels to support even a limited fishery. Consequently, considering the problems involved in marketing eels and the substantial financial investment required for gear, it would not seem advisable to enter into the eel fishery at this time.

Since anyone engaging in eel fishing in Louisiana at this time would be working under an experimental permit, there is no need to establish firm guidelines regarding trap design or mesh size. Under the present permit systems, a fisherman is required to have his particular gear approved by the Department of Wildlife and Fisheries prior to the issuing of a permit. This requirement appears sufficient at this time. Little is known of the movement and migration patterns of eels in this state, and since eels apparently do not spawn within state waters, it is unnecessary to establish a season for this fishery. No regulations are recommended regarding establishing size limits because eels are kept alive until they are graded and sold, and it is possible for buyers to release unharmed any undersized eels taken. Eel fishermen should, however, be restricted from the taking of elvers, since the capture of these young eels would surely reduce the adult population and preclude the possibility of any future development of this fishery.

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